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USERS GUIDE FOR THE MILSATCOM LOADING PROGRAM 'OPAL': GPSCS ADD--ETC(U)

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USERS GUIDE FOR THE MILSATCOM LOADING PROGRAM 'OPAL':
GPSCS ADDENDUM

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March 1978

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report describes the use of a modified computer program that interfaces with the JCS-approved User Requirements Data Base (URDB) to assess the ability of different satellites to meet stated requirements. Input to the program consists of specifications of various program options controlling the loading algorithm and "sieves" on the URDB. Dynamic modifications to selected entries of the URDB may be specified. | | |

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20. Program input also controls a flexible satellite data base, enabling loading analyses of various satellite configurations. Output consists of loading results summarized according to several criteria. The program runs on the IBM/370 at Reston, VA, or the IBM/360 at Arlington. Interactive program setup is available at the Reston facility.

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USERS GUIDE FOR THE MILSATCOM LOADING PROGRAM 'OPAL':
GPSCS ADDENDUM

1. INTRODUCTION.

1.1 Background.

This report describes modifications to the OPAL MILSATCOM Loading Program, in terms of its operation. OPAL is the acronym for a computer program, developed for the Defense Communications Agency (DCA) by ESL Incorporated, which interfaces the MILSATCOM Systems Office User Requirements Data Base (URDB) to provide summaries of satellite loading of various portions of that data base. OPAL was delivered to DCA in October 1977, along with a Final Report¹ and Users Guide.²

The computer program as delivered was limited to loading simulations involving AFSAT, FLTSAT and DSCS-II and -III satellite models. The computer program has since been expanded, under modification to contract DCA 100-77-C-0015, to provide the additional capability of handling various GPSCS configurations. The modifications incorporated are two fold: first, the addition of URDB masking routines, which provide for dynamic modification of entries of the URDB and its augmentation; second, the addition of a flexible satellite model data base and software providing for its manipulation.

¹P.D. Shaft, "Description of the MILSATCOM Loading Program 'OPAL', ESL Incorporated, Sunnyvale, CA, Report ESL-TM888, 30 Sept. 1977.

²G.D. Heinz, "Users Guide for the MILSATCOM Loading Program 'OPAL', ESL Incorporated, Sunnyvale, CA, Report ESL-TM887, 30 Sept. 1977.

1.1 -- Continued.

The features of the original OPAL Computer Program remain essentially unchanged; as such, the Final Report¹ and Users Guide² adequately describe these features. The purpose of this addendum is to describe features incorporated since delivery of the original computer program.

1.2 Organization of this Report.

The description of operation of OPAL Computer Program additions is organized into the following sections:

- URDB Masking (Section 2)
- GPSCS Data Base Manipulation (Section 3)
- Miscellaneous Operational Notes (Section 4).

This report is intended as a companion to the original users guide. The features, whose operation is described herein, are described in an addendum to the Final Report.³

³P.D. Shaft, "Description of the MILSATCOM Loading Program 'OPAL': GPSCS Addendum," ESL Incorporated, Sunnyvale, CA, Report ESL-TM939 March 1978.

2. URDB MASKING.

2.1 Introduction.

This section describes the operation of the URDB masking features of OPAL. URDB masking enables the user to dynamically modify one or more fields of any line item (i.e., entry) in the URDB or its augmentation. Alternatively, groups of line items may be identified by certain commonalities, involving one or more fields, and modifications made to each line item in the group. The Loading Program permits up to ten passes through the URDB prior to each run, a different mask being applied to each pass; after a run, the data base is restored to its original state.

Masking is accomplished, in both interactive and batch modes, by setting up a Mask Dataset. This dataset consists of two types of records:

- GET records, which define fields and field contents a line item is allowed to possess in order to be modified; and
- SET records, each of which defines a new value for a particular field, to be assigned each line item surviving the above "GET" test.

The simplest type of masking is that in which specific line items are designated for modification. In this case, the format of the GET record is

AB=lineitem1,lineitem2,...,lineitemn

2.1 -- Continued.

where lineitem1...lineitemn are concatenations of A- and B-field values. If necessary, owing to a large number of line items to be designated, several GET records may be used; i.e.,

```
AB=lineitem1,lineitem2,...,lineitemn
AB=lineitemp,...,lineitemq.
```

One SET record is created for each field to be modified; each has the following format:

```
field=value
```

where field is a field name (e.g., A,B,CC,DD, etc.) and value is the value to be assigned.

In addition to line-item searches, the program is capable of modifying entries based on the commonality of one or more fields. A GET record is created for each field referenced; e.g., the GET records

```
field1=valuel,...,valuen
field2=valuep,...,valueq
```

indicates that, in order for a URDB entry to be modified, its field field1 must contain one of valuel,...,valuen, and its field field2 must contain one of valuep,...,valueq.

For certain fields, whose entries are numeric, a range of values may be specified in a GET record. For example, the GET record

```
field1=valuel,value2-value3
```

2.1 -- Continued.

indicates, for an entry to be modified, its field field1 value must equal value1, or be between value2 and value3, inclusive. Specifically, the fields for which a value range may be specified are B,J,W,X,KK,LL,00-1,00-2,00-3 and 00-4.

The user has access to all fields in the URDB and URDB Augmentation, as indicated in Table 1. Many of the fields are not used by OPAL, and are so designated; the user is free to use them in any manner desired.

2.2 Mask Format Examples.

Example 1: In this example, specific URDB line items are to be modified. The line items are

CINCPAC003
CINCPAC004
CINCEUR001
ARMY103

The modifications are as follows:

| <u>Field</u> | <u>New Value</u> |
|--------------|------------------|
| P | GP |
| 00-1 | 2 |
| J | 3.9K |

The GET records are as follows:

AB=CINCPAC003,CINCPAC004,CINCEUR001
AB=ARMY103

Table 1. URDB and URDB Augmentation
Fields Accessed by Masking
Routines

| Field | Description | Valid Entries |
|-------|-------------------------------------|---------------------------------|
| A | Submitting Command | Any alphanumeric ≤8 char. |
| B | Control Field | Integer, 001-999 |
| C | Transaction (to change entry)* | Any alphanumeric 1 char. |
| D | Network Designation | Any alphanumeric ≤6 char. |
| E | Time Frame Required | C,M,L,F |
| F | Priority | J1-J7, S1-S5 |
| G | From: Area | 0,1,2,...7 |
| G-1 | From: State/Country | Any alphanumeric ≤2 char. |
| G-2 | From: Location* | Any alphanumeric ≤8 char. |
| G-3 | From: Operating Platform | A,B,F,P,S,T,V,X |
| H | To: Area | 0,1,2,...7 |
| H-1 | To: State/Country | Any alphanumeric ≤2 char. |
| H-2 | To: Location* | Any alphanumeric ≤8 char. |
| H-3 | To: Operating Platform | A,B,F,P,S,T,V,X |
| I | Type Service (Data, etc.) | D,F,I,M,R,T,V,Y |
| J | Data Rate | VA, numeric and multi- plier |
| K | Type Operation (Broadcast, etc.) | B,M,S,F,D,H,C |
| L | Service Availability | A,B,C,D,E,F,G,K,M,P, R,S,T,Y |

*Not used by OPAL

Table 1. -- Continued

| Field | Description | Valid Entries |
|-------|-----------------------------|--------------------------------|
| M | Quality of Service | D,T,3,4,5,6,M |
| N | How Presently Satisfied | Any alphanumeric 1 char. |
| O | Adequacy of Satisfaction | Any alphanumeric 1 char. |
| P | How Planned to be Satisfied | Any alphanumeric 2 char. |
| Q | WWMCCS/Non-WWMCCS | W,N,R,X |
| R | Alternatives Available* | Any alphanumeric 1 char. |
| S | Criteria for Inclusion* | Any alphanumeric 1 char. |
| T | (Reserved for Future)* | Any alphanumeric ≤3 char. |
| V | User Community (GMF, etc.) | A,C,D,F,G,I,N,S,U |
| W | Max. Number Terminals | 3 char. integer |
| X | Number Circuits | 01-99, 1x,2x,...9x,xx |
| Y | Source Document ID* | Any alphanumeric ≤3 char. |
| Z | Remarks* | Any alphanumeric ≤8 char. |
| AA | Submitting Command* | Any alphanumeric ≤8 char. |
| BB | Control Field | Integer 001-999 |
| CC | From Terminal Location Code | 2-digit Ref. Code Term Type |
| DD | From Terminal Location Code | 3-digit Ref. Code Term Loc. |
| EE | To Terminal Location Code | 2-digit Ref. Code Term Type |

*Not used by OPAL

Table 1. -- Continued

| Field | Description | Valid Entries |
|-------|------------------------------|-----------------------------|
| FF | To Terminal Location Code | 3-digit Ref. Code Term Loc. |
| GG | Transaction Code* | Any alphanumeric 1 char. |
| HH | Operational Scenario | 1-4 in each column |
| II | Potential Service Category | 1-4 |
| JJ | Satellite Transponder | 2-digit integer |
| KK | Required E_b/N_o | 4-digit numeric |
| LL | Bandwidth Expansion Factor | 4-digit numeric |
| MM | Multiple Access Technique | F,T,S |
| NN | Satellite of Preference | W,E,I,A |
| 00-1 | Force Multiplier, Scenario 1 | 01-99 |
| 00-2 | Force Multiplier, Scenario 2 | 01-99 |
| 00-3 | Force Multiplier, Scenario 3 | 01-99 |
| 00-4 | Force Multiplier, Scenario 4 | 01-99 |
| AB | Line Item | Composite of A and B fields |

*Not used by OPAL

2.2 -- Continued.

The SET records are as follows:

P=GP

00-1=2

J=3.9K .

Example 2: In this example, modifications are to be performed to line items possessing the following characteristics:

- A field entries are CINCPAC or CINCEUR
- B field entries are between 1 and 100
- P field contains D3 .

The modification is as follows:

| <u>Field</u> | <u>New Value</u> |
|--------------|------------------|
| P | GP . |

The GET records are:

A=CINCPAC,CINCEUR

B=1-100

P=D3 .

The SET record is:

P=GP .

2.3 Interactive Setup of a Mask Dataset.

Interactive setup of the Mask Dataset is accomplished via the MASK supervisor of the OPAL Interactive Setup Program in a manner similar to that of run setup; that is, the program assists the user in setting up mask records, and the program output (the Mask Dataset) is subsequently submitted to the batch loading program for processing. The interactive approach offers the advantage of reduced risk of user error by checking each mask record for syntax before it enters the Mask Dataset.

The MASK supervisor is entered from the COMMAND READY position by entering the command

MASK .

Upon exiting the MASK supervisor, control returns to the COMMAND READY position.

The command-ready position in the Mask supervisor is indicated by the prompt, "MASK". MASK supervisor commands are summarized in Table 2.

2.3.1 BEGIN Command.

The BEGIN command initiates a process in which GET and SET records are input. First to be requested are the GET records; each GET record is assigned a unique number, G01 through G99. After 1 record is entered the next record is requested. If an error occurs, the error is signalled and the record re-requested. When the last GET record has been entered, a carriage return is entered following the next record request.

Table 2. MASK Supervisor Commands

| Command | Description |
|----------|---|
| BEGIN | Begins a request sequence for new GET and SET records. |
| ADD | Begins a request sequence for GET and SET records to be added to the current set. |
| END | Returns control to COMMAND READY. |
| MODIFY | Modifies a specific GET or SET record. |
| RETRIEVE | Retrieves a Mask from the Mask Dataset. |
| STATUS | Lists the current GET and SET records. |
| SUBMIT | Copies current GET and SET records into the Mask Dataset, creating a Mask. |

2.3.1 -- Continued.

The program then proceeds to request each SET record, identified S01 through S99, in a similar manner. When the last SET record has been entered, a carriage return is entered following the next record request to return the program to the MASK position. Note: In interactive mode, each GET or SET record may be 72 characters or less in length.

2.3.2 ADD Command.

The ADD command is used to place additional GET and SET records in the current set. The additional records are requested, and the input process terminated, in the manner described for the BEGIN command.

2.3.3 END Command.

The END command returns the program to the COMMAND READY position.

2.3.4 MODIFY Command.

The MODIFY command is used to modify a current Mask by replacing a specific GET or SET record. When the command is issued, the program requests the identification (e.g., G03) of the record to be replaced. The new record is then entered. One MODIFY command is required for each record to be replaced.

2.3.5 RETRIEVE Command.

The RETRIEVE command is used to retrieve a Mask from the Mask Dataset (e.g., previously submitted via the SUBMIT command). The Mask to be retrieved is identified by the number it was assigned

2.3.5 -- Continued.

when submitted. If the specified Mask is found, current GET and SET records will reflect those of the retrieved Mask.

2.3.6 STATUS Command.

The STATUS command prints all current GET and SET records.

2.3.7 SUBMIT Command.

The SUBMIT command is used to submit a Mask to the Mask Dataset. When the command is issued, the current GET and SET records are copied into the Dataset and a Mask number assigned; this number must be referenced when retrieving a Mask or when assigning Mask(s) to a particular run (refer to Section 4).

2.3.8 Mask Supervisor Example.

COMMAND READY
MASK

◆◆◆MASK SETUP SUPERVISOR◆◆◆

(0 MASKS HAVE BEEN SUBMITTED)

MASK

BEGIN

◆◆◆"GET" MASKS◆◆◆

G01:

AB=CINCPAC001,CINCPAC002

G02:

AB=CINCEUR100,CINCEUR101,ARMY001

G03:

◆◆◆"SET" MASKS◆◆◆

S01:

F=GF

2.3.8 -- Continued.

```

S02:
DD-1=2
S03:
J=3.9K
S04:
-----
MASK
STATUS
***"GET" MASKS***
G01: AS=CINCPAC001,CINCPAC002
G02: AS=CINCELP100,CINCEUR101,ARMY001
***"SET" MASKS***
S01: P=GP
S02: DD-1=2
S03: J=3.9K
MASK
SUBMIT
***SUBMITTED AS MASK NUMBER 1
MASK

```

2.4 Batch Setup of a Mask Dataset.

URDB masking operations may be performed in batch mode, that is, bypassing the Interactive Setup Program. In order to do so, it is necessary to create a punched cardset, which is then submitted to the OPAL Loading Program for processing. The user should exercise caution in setting up the cardset; the Loading Program will ignore any GET or SET record which contains an error.

The masking control cardset, identical in format to the Mask Dataset created by the interactive program, consists of GET and SET records as described in Subsection 2.1, plus the following additional control cards (normally generated by the interactive program):

2.4 -- Continued.

- Mask location record (one per job)
- Mask size record (one per Mask) .

The records are placed in the following order to create a Mask Dataset:

Mask Location Record

Mask Size Record for Mask 1

GET Records for Mask 1

SET Records for Mask 1

Mask Size Record for Mask 2

GET Records for Mask 2

SET Records for Mask 2

•
•
•

2.4 -- Continued.

The mask location record defines the starting point of each Mask in the Dataset, in terms of locations of the mask size records. The format of the mask location record is as follows:

| <u>Column</u> | <u>Description</u> |
|---------------|----------------------------------|
| 1-3 | Location of mask-size record 1 |
| 4-6 | Location of mask-size record 2 |
| • | |
| • | |
| • | |
| 28-30 | Location of mask size record 10. |

The entry in each of the above fields is a right-justified integer.

The mask-size record, in turn, defines the number of GET and SET records in a particular mask. The format of the mask-size record follows:

| <u>Column</u> | <u>Description</u> |
|---------------|-------------------------|
| 1-3 | Number of GET records |
| 4-6 | Number of SET records . |

The entry in each of the above fields is a right-justified integer.

Note: In batch mode, each GET or SET record is limited to 80 characters in length.

Example. In this example, the two Masks described in Examples 1 and 2 of Subsection 2.2 are set up for batch submission. The resulting cardset follows:

2.4 -- Continued.

| <u>Rec. No.</u> | <u>Contents</u> |
|-----------------|-------------------------------------|
| 1 | 2 8 |
| 2 | 2 3 |
| 3 | AB=CINCPAC003,CINCPAC005,CINCEUR001 |
| 4 | AB=CINCEUR002,ARMY103 |
| 5 | P=GP |
| 6 | 00-1=2 |
| 7 | J=3.9K |
| 8 | 3 1 |
| 9 | A=CINCPAC,CINCEUR |
| 10 | B=1-100 |
| 11 | P=D3 |
| 12 | P=GP |

3. GPSCS DATA BASE MANIPULATION.

3.1 Introduction.

This section describes manipulation of the GPSCS Data Base. Methods are described for accomplishing the following:

- creating a new model in the data base by supplying all parameter values;
- creating a new model in the data base by overriding certain parameter values within an existing entry;
- replacing an existing model in the Data Base by either of the above methods.

Modifications may be performed either in the interactive or in the batch mode; both are described herein. Before attempting operations on the GPSCS Data Base it is necessary to have an idea of its structure; this is the purpose of the following subsection.

3.2 GPSCS Data Base Structure.

The data base consists of four record groups: antennas, jammers, satellite configurations and transponders. Within each group individual entries (up to 99) are identified by number.

A complete satellite model is a collection of one satellite configuration entry, one or more each antenna and transponder entries and, optionally a jammer entry. The satellite configuration entry contains information on the satellite location, and on the numbers and "types" of antennas and transponders. Optionally, a jammer

3.2 -- Continued.

number indicated on a transponder entry references an entry within the jammer group.

Each satellite model therefore involves several entries in the GPSCS Data Base. These entries may already exist; if not, existing entries may be modified or new entries created to form the satellite model.

Modifications to the GPSCS Data Base are performed by indicating the following:

- record type ("RECTYP") - the type (or group) of the entry to be created;
- new record identifier ("NEWREC") - the number assigned the new entry;
- new parameter values - the value of each parameter appropriate to the record type;
- old record identifier ("OLDREC") - (optional) the number of the existing record (of the same RECTYP) from which undefined parameter values are to be obtained.

The following may in this way be accomplished:

- create a new entry, specifying all parameter values (the new entry is identified by RECTYP and NEWREC; OLDREC is omitted);

3.2 -- Continued.

- create a new entry by overriding certain parameters within an existing entry (the new entry is identified by RECTYP and NEWREC; the old entry is identified by RECTYP and OLDREC);
- replace an existing model (NEWREC is specified as a pre-existing entry and the pre-existing entry is overwritten; OLDREC and NEWREC may be the same).

The following subsections describe methods for modifying the GPSCS data base in interactive and batch modes. Modifications are job-temporary.

3.3 Interactive Data Base Manipulation.

Interactive Data Base manipulation is performed via the GPSCS Supervisor within the OPAL Interactive Setup Program, in a manner similar to that of run setup; that is, the program assists the user in setting up the modifications and the program output (the Modifications Dataset) is then submitted to the Batch Loading Program for processing. The interactive approach offers the advantage of reduced risk of user error by checking modifications for completeness, consistency and syntax.

The GPSCS supervisor is entered from the COMMAND READY position by the command

GPSCS .

3.3 -- Continued.

Upon exiting the GPSCS supervisor control returns to the COMMAND READY position.

The command-ready position in the GPSCS supervisor is indicated by the prompt, "GPSCS". GPSCS supervisor commands are summarized in Table 3.

3.3.1 BEGIN Command.

The BEGIN command initiates an input process in which various parameters are assigned values. The first parameters requested pertain to entry identification; these are defined in Table 4. The values assigned to the entry identification parameters determine which of the remaining parameters are assigned values, and the manner in which value assignment takes place.

Specifying OLDREC=N indicates that no existing entry is to be used; therefore, each parameter must be assigned a value by the user. The program requests all appropriate parameters (defined in Tables 5 through 8), depending on RECTYP. Each value entered is checked for correct structure and value; an error is signalled and the value re-requested. Entering a carriage return following the parameter request results in a default value assignment. When the last parameter value has been assigned, the program returns to the GPSCS position.

Specifying OLDREC other than N indicates that an existing entry is to supply certain parameter values; therefore, only these parameters whose values differ from the OLDREC values are assigned values. For each parameter whose value is to be changed the following statement is entered:

Table 3. GPSCS Supervisor Commands

| Command | Description |
|----------|--|
| BEGIN | Begins request sequence for entry identification and parameter value assignment |
| DELETE | Deletes a previously submitted entry from the Modifications Dataset |
| END | Returns control to COMMAND READY |
| MODIFY | Modifies the value(s) of individual parameter(s) |
| RETRIEVE | Retrieves an entry from the Modifications Dataset |
| SCAN | Summarizes entries in the Modifications Dataset |
| STATUS | Prints current entry identification and parameter values |
| SUBMIT | Copies current identification and parameter values to create an entry in the Modifications Dataset |

Table 4. Parameters Pertaining to Entry Identification

| Name | Description | Valid Entries | Default |
|--------|---|--|---------|
| RECTYP | Type of entry | A=antenna; J=jammer; S=satellite; T=transponder | A |
| OLDREC | Existing data base entry referenced* | Integer in [1,99]; N=none | N |
| NEWREC | Designator of new entry | Integer in [1,99] | 1 |

* When an old entry is specified,
it must already exist in the
GPSCS Data Base

Table 5. Parameters Pertaining to Antenna Entries

| Name | Description | Valid Entries | Default |
|--------|--|--|---------|
| ATYPE | Antenna type | EC=earth coverage; AC=area coverage; NC=narrow coverage; SCAN=scanning coverage; WIDE=wide coverage; ARRAY=phased array with steerable nulls | EC |
| AGAIN | Boresight gain, dB | Real number | 20 |
| BEAMW | Beamwidth, degrees ¹ | Positive real number | 17.3 |
| NULLGN | Gain of superimposed nulls, dB ² | Real number | 0 |
| NULLBW | Beamwidth of super- imposed nulls, degrees ² | Real positive number | 17.3 |
| PLAT | Latitude of boresight intersection, degrees ¹ | Real number from -90 to +90, plus N=north or S=south (optional) | 0 |
| PLON | Longitude of boresight intersection, degrees ¹ | Real number from -360 to +360, plus E=east or W=west (optional) | 0 |

¹valid for types AC and NC only²valid for type ARRAY only

Table 6. Parameters Pertaining to Jammer Entries

| Name | Description | Valid Entries | Default |
|-------|---|---|---------|
| JLAT | Latitude, degrees | Real number from -90 to +90, plus N=north or S=south (optional) | 0 |
| JLON | Longitude, degrees | Real number from -360 to +360, plus E=east or W=west (optional) | 0 |
| ERPJ | Effective isotropic radiated power, dBW | Real number | 0 |
| JTYPE | Jammer type | WB=wideband; NB=narrowband | WB |

Table 7. Parameters Pertaining to Satellite Configuration Entries

| Name | Description | Valid Entries | Default |
|----------|--|---|---------|
| NANT | Number of antennas | Integer in [1,25] | 1 |
| NXPON | Number of transponders | Integer in [1,25] | 1 |
| SATLON | Satellite longitude, degrees | Real number from -360 to +360, plus E=cast or W=west (optional) | 0 |
| AMOD-nn | Antenna model (entry) assigned to antenna nn* | Integer in [1,99] | 1 |
| XMOD-nn | Transponder model (entry) assigned to transponder number nn* | Integer in [1,99] | 1 |
| UPANT-nn | Antenna number feeding transponder nn | Integer in [1,NANT] | 1 |
| DNANT-nn | Antenna number fed by transponder nn | Integer in [1,NANT] | 1 |

* Entries must reference defined entries in the GPSCS Data Base

Table 8. Parameters Pertaining to Transponder Entries

| Name | Description | Valid Entries | Default |
|--------|------------------------------------|---|---------|
| MLTACC | Multiple-access method | F=FDMA; S=SSMA; T=TDMA | F |
| XGAIN | Gain index | Integer in [1,5] | 1 |
| PMAX | Saturated power, watts | Positive real number | 10 |
| BANDW | Bandwidth, Hz | Positive real, plus optional multiplier: $K=10^3, M=10^6, G=10^9$ | 10^6 |
| TEMP | Noise temperature, degrees Kelvin | Positive real number | 2500 |
| UPLOSS | Uplink line loss, dB | Real number | 0 |
| DNLOSS | Downlink line loss, dB | Real number | 0 |
| PSTEP | Power-quantizing stepsize, dB | Real number | 0 |
| RTLOSS | Reserve-time loss, dB ¹ | Real number | 0 |
| UPFREQ | Uplink frequency, Hz | Positive real, plus optional multiplier: $K=10^3, M=10^6, G=10^9$ | 10^9 |

Table 8. -- Continued

| Name | Description | Valid Entries | Default |
|--------|--------------------------------------|--|-----------------|
| DNFREQ | Downlink frequency, Hz | Positive real, plus optional multiplier: K=10 ³ , M=10 ⁶ , G=10 ⁹ | 10 ⁹ |
| IM | Intermodulation option | Y=include IM; N=do not include IM | Y |
| UPLINK | Uplink option | Y=include uplink; N=do not include uplink | Y |
| BKOFF | Uplink power backoff, dB | Real number | 0 |
| DESPRD | PN despreading option | S=satellite despreading; G=ground despreading; N=no despreading | N |
| DSGAIN | PN despreading gain, dB ² | Real number | 0 |
| DEHOP | Frequency dehoppping option | Y=frequency dehoppping; N=no frequency dehoppping | N |

Table 8. -- Continued

| NAME | Description | Valid Entries | Default |
|--------|--|---------------------------|---------|
| DHGAIN | Frequency dehopping gain, dB ³ | Real number | 0 |
| JAMMER | Jammer applied against uplink ⁴ | Integer in [1,99]; N=none | N |

¹Valid for type TDMA only

²Valid only when despreading specified

³Valid only when dehopping specified

⁴Refers to a defined jammer entry in the GPSCS Data Base

3.3.1 -- Continued.

name = value

where name is selected from Tables 4 through 8, as appropriate. After the last modification has been entered, a carriage return on the next line returns the program to the GPSCS position.

3.3.2 DELETE Command.

The DELETE command is used to delete an entry from the Modifications Dataset. The program requests the entry identification by its RECTYP and NEWREC values, whereupon the entry is deleted.

3.3.3 END Command.

The END command returns program control to the COMMAND READY position.

3.3.4 MODIFY Command.

The MODIFY command is used to modify parameter values. After the MODIFY command is entered, one or more value reassignments may be entered, each in the following format:

name = value ,

where name is selected from Tables 4 through 8 (as appropriate for the current RECTYP) and value is the new parameter value.

Note: The following parameters may not be altered by the MODIFY command:

3.3.4 -- Continued.

RECTYP

OLDREC

NANT

NXPON

ATYPE

MLTACC

DESPRD

DEHOP .

3.3.5 RETRIEVE Command.

The RETRIEVE command is used to retrieve an entry previously submitted to the Modifications Dataset by the SUBMIT command. The program requests entry identification by RECTYP and NEWREC values, whereupon the entry is retrieved; i.e., all parameter values reflect those of the retrieved entry.

3.3.6 SCAN Command.

The SCAN command provides a summary of entries in the Modifications Dataset, by listing their RECTYP and NEWREC values.

3.3.7 STATUS Command.

The STATUS command prints the current values of the RECTYP, OLDREC and NEWREC parameters, and remaining appropriate parameters. If OLDREC identifies an existing Data Base entry, only those parameters designated for modification are listed.

3.3.8 SUBMIT Command.

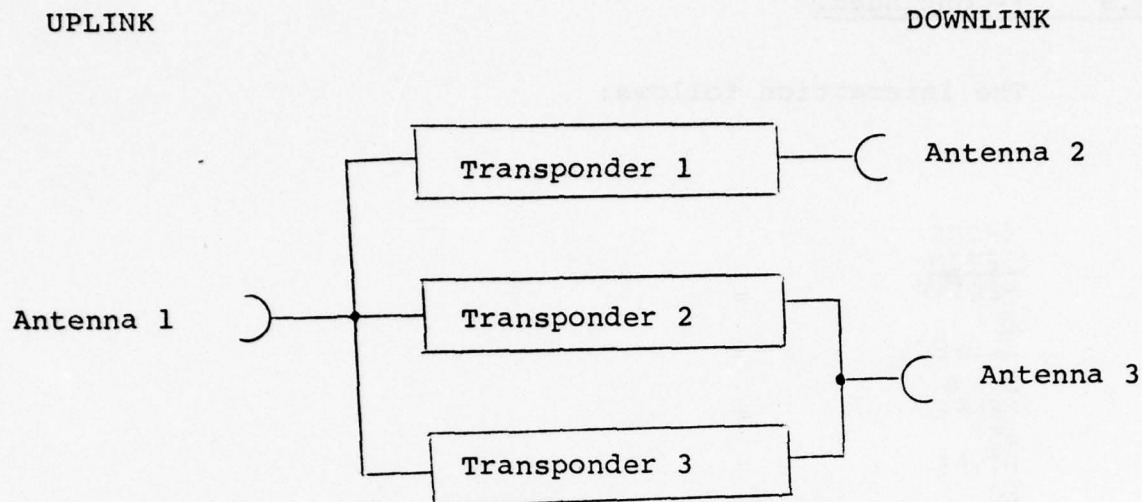
The SUBMIT command copies current parameter values into the Modifications Dataset for later processing by the Batch Loading program.

3.3.9 GPSCS Supervisor Example.

This example demonstrates the interactive setup of a satellite model in the GPSCS Data Base. The satellite model to be entered is diagrammed in Figure 1; the translation of this diagram to a Data Base model consists of specifying appropriate antenna, jammer, satellite configuration and transponder entries.

The model consists of three antennas; however, since parameter values of antennas 1 and 2 are identical, only two model entries need be set up. Each entry is set up, using the BEGIN command, by assigning values to the entry identification parameters (Table 4) and antenna parameters (Table 5). Entry identification parameters define the following:

- type of entry to be set up (in this case, RECTYP=A, or antenna);
- location of an existing GPSCS antenna entry to supply certain parameter values (in this case, OLDREC=N, or none);
- location of the new GPSCS antenna entry (in this case, arbitrarily NEWREC=25 and 30, respectively).



Antenna parameters:

| <u>Antenna</u> | <u>Type</u> | <u>Gain</u> | <u>Beamwidth</u> | <u>P-lat</u> | <u>P-lon</u> |
|----------------|-------------|-------------|------------------|--------------|--------------|
| 1 | EC | 20dB | 17.3 deg | - | - |
| 2 | EC | 20dB | 10 deg | - | - |
| 3 | AC | 40dB | 10 deg | 13 N | 128 W |

Transponder parameters:

| <u>Transponder</u> | <u>Mlt. Acc.</u> | <u>Power</u> | <u>Bandwidth</u> | <u>Uplink Freq.</u> | <u>Downlink Freq.</u> |
|--------------------|------------------|--------------|------------------|---------------------|-----------------------|
| 1 | FDMA | 10 | 20 MHz | 6.5 GHz | 3.5 GHz |
| 2 | FDMA | 10 | 40 MHz | 7.5 GHz | 4.5 GHz |
| 3 | FDMA | 20 | 40 MHz | 8.5 GHz | 5.5 GHz |

Figure 1. Hypothetical Satellite Model.

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3.3.9 --Continued.

The interaction follows:

```

GPSOC
BEGIN
RECTYP      =
A
OLDREC      =
N
NEWREC      =
25
ATYPE      =
EC
AGAIN      DB  =
20
BEAMW      DEG =
17.3

GPSOC
STATUT
RECTYP      =          A
OLDREC      =          N
NEWREC      =          25
ATYPE      =          EC
AGAIN      =      20.00  DB
BEAMW      =      17.30  DEG

GPSOC
SUBMIT
◆◆◆SUBMITTED◆◆◆

GPSOC
BEGIN
RECTYP      =
A
OLDREC      =
N
NEWREC      =
20
ATYPE      =
EC
AGAIN      DB  =
40

```

3.3.9 --Continued.

```

BEAMW      DEG  =
10
PLAT       DEG  =
13 N
PLON       DEG  =
128 W
GPSCS
STATUS
RECTYP     =          A
OLIREC     =          N
NEWREC     =          30
ATYPE      =          AC
AGAIN      =          40.00  DB
BEAMW      =          10.00  DEG
PLAT       =          13.00  DEG  N
PLON       =          128.00  DEG  W
GPSCS
SUBMIT
◆◆◆SUBMITTED◆◆◆

```

Next, the transponder entries are set up. Since the transponders are dissimilar, three unique transponder entries in the GPSCS Data Base are required. Each entry is set by assigning values to the entry identification (Table 4) and transponder (Table 8) parameters. Entry identification parameters define the following:

- type of entry to be set up (in this case, RECTYP=T, or transponder);

3.3.9 --Continued.

- location of an existing GPSCS transponder entry to supply certain parameter values (in this case, OLDREC=N, or none);
- location of the new GPSCS transponder entry (in this case, arbitrarily NEWREC=21, 22, 23, respectively).

Each of the transponder entries could be set by repeated use of the BEGIN command. Instead, since the transponder models contain some similar parameter values, the first model will be set up using the BEGIN command, and the remaining models by using the MODIFY command. Those transponder parameters not defined in Figure 1 will be assigned default values. The interaction follows:

```

GPSCS
BEGIN
RECTYP      =

T
OLDREC      =
N
NEWREC      =
21
ALTACC      =
E
XGAIN       =

---♦♦♦DEFAULT VALUE ENTERED:
XGAIN      =      1
PMAK      W      =
10
BANDW      HZ      =
20 M

```

3.3.9 --Continued.

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```

TEMP      DEGK =

---♦♦♦DEFAULT VALUE ENTERED:
TEMP      =      2500.00   DEGK
UPLOSS    DB    =

---♦♦♦DEFAULT VALUE ENTERED:
UPLOSS    =      0.0     DB
DNLOSS    DB    =

---♦♦♦DEFAULT VALUE ENTERED:
DNLOSS    =      0.0     DB
UPFREQ    HZ    =
3.5 G
DNFREQ    HZ    =
3.5 G
IM        =

---♦♦♦DEFAULT VALUE ENTERED:
IM        =      Y
UPLINK    =

---♦♦♦DEFAULT VALUE ENTERED:
UPLINK    =      Y
BKOFF     DB    =

---♦♦♦DEFAULT VALUE ENTERED:
BKOFF     =      0.00   DB
PWRAN     DBW   =

---♦♦♦DEFAULT VALUE ENTERED:
PWRAN     =      -500.00 DBW
DESPRD    =

---♦♦♦DEFAULT VALUE ENTERED:
DESPRD    =      N
DEHOP     =

---♦♦♦DEFAULT VALUE ENTERED:
DEHOP     =      N
JAMMER    =

---♦♦♦DEFAULT VALUE ENTERED:
JAMMER    =      N

```

3.3.9 --Continued.

```

GPSOS
STATUS
RECTYP      =          T
OLDREC      =          N
NEWREC      =          21
MLTRCC      =          F
NGAIN       =          1
PMAK        =      10.00   W
BANDW       =      20.00   MHZ
TEMP        =      2500.00 DEGR
UPLOSS      =          0.0   DB
INLOSS      =          0.0   DB
UPFREQ      =          6.50   GHZ
INFREQ      =          3.50   GHZ
IM          =          Y
UPLINK      =          N
BKOFF       =          1.00   DB
PWRN        =     -500.00   DBM
DESPD       =          N
DEHOP       =          N
JAMMER      =          N

```

GPSOS

SUBMIT

◆◆◆SUBMITTED◆◆◆

GPSOS

MODIFY

◆◆◆ENTER MODIFICATIONS◆◆◆

NEWREC=22BANDW=40 MUPFREQ=7.5 GINFREQ=4.5 G

GPSOS

STATUS

```

RECTYP      =          T
OLDREC      =          N
NEWREC      =          22
MLTRCC      =          F
NGAIN       =          1
PMAK        =      10.00   W
BANDW       =      40.00   MHZ
TEMP        =      2500.00 DEGR
UPLOSS      =          0.0   DB
INLOSS      =          0.0   DB

```

3.3.9 --Continued.

UFFREQ = 7.50 GHZ
DNFREQ = 4.50 GHZ
IM = Y
UPLINK = N
BKOFF = 1.00 DB
PMARN = -500.00 DBW
DESPRD = N
DEHOP = N
JAMMER = N

GPSCS

SUBMIT

SUBMITTED

GPSCS

MODIFY

ENTER MODIFICATIONS

NEWREC=23

PMAX=20

UFFREQ=8.5 G

DNFREQ=5.5 G

GPSCS

STATUS

RECTYP = T
OLIREC = N
NEWREC = 23
MLTACC = F
XGAIN = 1
PMAX = 20.00 W
BANDW = 40.00 MHZ
TEMP = 2500.00 DEGK
UPLOSS = 0.0 DB
DNLOSS = 0.0 DB
UFFREQ = 8.50 GHZ
DNFREQ = 5.50 GHZ
IM = Y
UPLINK = N
BKOFF = 1.00 DB
PMARN = -500.00 DBW
DESPRD = N
DEHOP = N
JAMMER = N

SUBMIT

SUBMITTED

3.3.9 --Continued.

Finally, the satellite configuration entry is set up in a similar manner, by specifying entry identification (Table 4) and satellite configuration parameter (Table 7) values. Entry identification parameters define the following:

- type of entry to be set up (in this case, RECTYP=S, or satellite configuration);
- location of an existing GPSCS satellite configuration entry to supply certain parameter values (in this case, OLDREC=N, or none);
- location of the new GPSCS Satellite Configuration entry (in this case, arbitrarily NEWREC=1).

It should be noted that several of the satellite configuration parameters (specifically AMOD-nn and XMOD-nn) refer to entry numbers (i.e., locations) of appropriate type entries in the GPSCS data base; these entries have been entered, and their locations specified by NEWREC, in the above steps.

The interaction follows:

| | |
|--------|---|
| GPSCS | |
| BEGIN | |
| RECTYP | = |
| 2 | |
| OLDREC | = |
| N | |
| NEWREC | = |
| 1 | |

3.3.9 --Continued

| | |
|--------------|-------|
| NRNT | = |
| <u>3</u> | |
| NRPN | = |
| <u>3</u> | |
| SATLON | DEG = |
| <u>115 W</u> | |
| AMOD-01 | = |
| <u>25</u> | |
| AMOD-02 | = |
| <u>25</u> | |
| AMOD-03 | = |
| <u>30</u> | |
| XMOD-01 | = |
| <u>21</u> | |
| XMOD-02 | = |
| <u>22</u> | |
| XMOD-03 | = |
| <u>23</u> | |
| UPANT-01 | = |
| <u>1</u> | |
| UPANT-02 | = |
| <u>1</u> | |
| UPANT-03 | = |
| <u>1</u> | |
| DNANT-01 | = |
| <u>2</u> | |
| DNANT-02 | = |
| <u>3</u> | |
| DNANT-03 | = |
| <u>3</u> | |
| GPSCS | |

3.3.9 --Continued.

| | | | |
|-----------------|---|--------|-------|
| STATUS | | | |
| RECTYP | = | S | |
| OLDREC | = | N | |
| NEWREC | = | 1 | |
| NANT | = | 3 | |
| NXPON | = | 3 | |
| SATLON | = | 115.00 | DEG W |
| AMOD-01 | = | 25 | |
| AMOD-02 | = | 25 | |
| AMOD-03 | = | 30 | |
| XMOD-01 | = | 21 | |
| XMOD-02 | = | 22 | |
| XMOD-03 | = | 23 | |
| UPANT-01 | = | 1 | |
| UPANT-02 | = | 1 | |
| UPANT-03 | = | 1 | |
| DNANT-01 | = | 2 | |
| DNANT-02 | = | 3 | |
| DNANT-03 | = | 3 | |
| GPSCS | | | |
| SUBMIT | | | |
| ◆◆◆SUBMITTED◆◆◆ | | | |

3.3.9 --Continued.

The satellite model in Figure 1 is now complete and its entries will be loaded, upon execution of the Loading Program, into the GPSCS Data Base. Since the location of the satellite configuration entry for this GPSCS model has been designed as 1 (i.e., NEWREC=1), this model may be accessed for loading by specifying

```
(07)NAME=GP  
(08)MODEL ID=1
```

when setting up loading runs.

3.4 Batch Data Base Manipulation.

Batch Data Base Manipulation is performed by setting up a Modifications Dataset consisting of punched cards; this cardset is then submitted to the OPAL Loading Program for processing. The user should exercise caution in setting up the cardset, as the program may terminate if an error occurs.

The batch-modification interpreter within the Loading Program utilizes the NAMELIST feature of IBM Fortran, wherein only selected parameters are assigned values on a "READ" statement. This feature simplifies value assignment, since only those parameters whose values are to change need be defined.

For each entry to be modified, two NAMELIST inputs (each input consisting of one or more cards) are submitted: The RECORD card and the DATA card. Multiple-entry modifications consist of appropriate RECORD and DATA inputs placed in sequence.

3.4 -- Continued.

The RECORD input assigns entry identification parameters, defined in Table 9.* The format of the RECORD input is

```
&RECORD OLREC=nn,NEWREC=nn,RECTYP=nn,&END
```

where the first ampersand (&) is placed in column 2.

The DATA input specifies remaining value assignments to the new entry. The format of the DATA input is

```
&DATA
.
.
.
name1=value1,name2=value2,...,namen=valuen,
.
.
.
&END
```

where name1,name2,...,namen are selected from Tables 10 through 13,* and value1, value2,...,valuen are the values to be assigned. The first nonblank character in each card is placed in Column 2; columns 2 through 80 may contain NAMELIST data.

Note: In addition to setting up the NAMELIST cardset, it is necessary to indicate on the job control card that this feature is being used. (Refer to Section 4).

* Tables 9 through 13 list value restrictions when using the NAMELIST feature for Data Base modifications. The parameter definitions provided in Tables 4 through 8 are still applicable.

Table 9. Record Identification Parameters:
Valid Entries in Batch Mode

| Name | Valid Entries |
|--------|--|
| RECTYP | 1=Antenna; 2=Jammer; 3=Satellite; 4=Transponder |
| OLDREC | Integer in [1,99]; 0=none |
| NEWREC | Integer in [1,99] |

Table 10. Antenna Model Parameters;
Valid Entries in Batch Mode

| Name | Valid Entries |
|--------|--|
| ATYPE | 1=earth coverage; 2=area coverage; 3=narrow coverage; 7=scanning coverage; 8=wide coverage; 9=phased array with steerable nulls |
| AGAIN | Real number |
| BEAMW | Positive real number |
| NULLGN | Real number |
| NULLBW | Positive real number |
| PLAT | Real number from -90 to 90 |
| PLON | Real number from -360 to 360 |

Table 11. Jammer Parameters: Valid Entries in Batch Mode

| Name | Valid Entries |
|-------|-------------------------------|
| JLAT | Real number from -90 to +90 |
| JLON | Real number from -360 to +360 |
| ERP.J | Real number |
| JTYPE | 1=wideband; 2=narrowband |

Table 12. Satellite Model Configuration Parameters
Valid Entries in Batch Mode

| Name | Valid Entries |
|------------|-------------------------------|
| NANT | Integer in [1,25] |
| NXPON | Integer in [1,25] |
| SATLON | Real number from -360 to +360 |
| AMOD (nn) | Integer in [1,99] |
| XMOD (nn) | Integer in [1,99] |
| UPANT (nn) | Integer in [1,NANT] |
| DNANT (nn) | Integer in [1,NANT] |

Table 13. Transponder Model Parameters:
Valid Entries in Batch Mode

| Name | Valid Entries |
|--------|------------------------|
| MLTACC | 1=SSMA; 2=FDMA; 3=TDMA |
| XGAIN | Integer in [1,5] |
| PMAX | Positive real number |
| BANDU | Positive real number |
| TEMP | Positive real number |
| UPLOSS | Real number |
| DNLOSS | Real number |
| PSTEP | Real number |
| RTLOSS | Real number |
| UPFREQ | Positive real number |
| DNFREQ | Positive real number |

Table 13. -- Continued

| Name | Valid Entries |
|--------|---|
| IM | 1=include IM; 0=do not include IM |
| UPLINK | 1=include uplink; 0=do not include uplink |
| BKOFF | Real number |
| DESPRD | 0=no desreading; 1=satellite desreading; 2=ground desreading |
| DSGAIN | Real number |
| DEHOP | 0=no dehopping; 1=dehopping |
| DHGAIN | Real number |
| JAMMER | Integer in [1,99]; 0=no jammer |

3.5 Batch Data Base Manipulation Example.

This example demonstrates the batch setup of a satellite model in the GPSCS Data Base. The satellite model to be entered illustrated in Figure 1; its interactive setup was shown in 3.3.9; the resulting data base configuration is identical to that created by the Interactive Setup Example.

Batch setup is similar in principle to interactive setup; however, the following exceptions apply:

- entries are handled via NAMELIST processing;
- each entry requires a &RECORD input, to define entry identification parameters, and a &DATA input, to assign model parameters;
- the "valid entries" listed in Tables 4 through 8 are replaced by those listed in Tables 9 through 13, respectively.

The antenna entry for model number 25 is set up by defining the entry identification parameters.

```
&RECORD RECTYP=1,OLDREC=0,NEWREC=25,&END
```

and the model parameters.

```
&DATA ATYPE=1,AGAIN=20,BEAMW=17.3,&END
```

The antenna entry for model number 30 is set up in a similar manner:

3.5 --Continued.

```
&RECORD RECTYP=1,OLDREC=0,NEWREC=30,&END
&DATA ATYPE=2,AGAIN=40.,BEAMW=10.,&END
```

The transponder entries may be set up by either of two methods. The first method defines the value of each transponder parameters (parameters not referenced will be assigned default values):

```
&RECORD RECTYPE=4,OLDREC=0,NEWREC=21,&END
&DATA MLTACC=2,PMAX=10.,BANDW=20E6,UPFREQ=6.5E9,
DNFREQ=3.5E9,&END
&RECORD RECTYP=4,OLDREC=0,NEWREC=22,&END
&DATA MLTACC=2,PMAX=10.,BANDW=40E6,UPFREQ=7.5E9,
DNFREQ=4.5E9,&END
&RECORD RECTYP=4,OLDREC=0,NEWREC=23,&END
&DATA MLTACC=2,PMAX=20.,BANDW=40E6,UPFREQ=8.5E9,
DNFREQ=5.5E9,&END
```

The other method assigns values to the first transponder model then makes use of this model (by specifying OLDREC) changing only those parameter values which differ:

```
&RECORD RECTYP=4,OLDREC=0,NEWREC=21,&END
&DATA MLTACC=2,PMAX=10.,BANDW=20E6,UPFREQ=6.5E9,
DNFREQ=3.5E9,&END
&RECORD RECTYP=4,OLDREC=21,NEWREC=22,&END
&DATA BANDW=40E6,UPFREQ=7.5E9,DNFREQ=4.5E9,&END
&RECORD RECTYP=4,OLDREC=21,NEWREC=23,&END
&DATA PMAX=20.,BANDW=40E6,UPFREQ=8.5E9,DNFREQ=5.5E9,&END
```

Finally the satellite configuration entry is set up by appropriate &RECORD and &DATA inputs:

3.5 --Continued.

```
&RECORD RECTYP=3,OLDREC=0,NEWREC=1,&END
&DATA NANT=3,NXPON=3,SATLON=-115.,
AMOD(1)=25,AMOD(2)=25,AMOD(3)=30,
XMOD(1)=21,XMOD(2)=22,XMOD(3)=23,
UPANT(1)=1,UPANT(2)=1,UPANT(3)=1,
DNANT(1)=2,DNANT(2)=3,DNANT(3)=3,
&END
```

The various NAMELIST are then stacked as input to the loading program. The resulting cardset follows:

```
&RECORD RECTYP=1,OLDREC=0,NEWREC=25,&END
&DATA ATYPE=1,AGAIN=20.,BEAMW=17.3,&END
&RECORD RECTYP=1,OLDREC=0,NEWREC=30,&END
&DATA ATYPE=2,AGAIN=40,BEAMW=10.,&END
&RECORD RECTYP=4,OLDREC=0,NEWREC=21,&END
&DATA MLTACC=2,PMAX=10.,BANDW=20E6,UPFREQ=6.5E9,
DNFREQ=3.5E9,&END
&RECORD RECTYP=4,OLDREC=0,NEWREC=22,&END
&DATA MLTACC=2,PMAX=10.,BANDW=40E6,UPFREQ=7.5E9,
DNFREQ=4.5E9,&END
&RECORD RECTYP=4,OLDREC=0,NEWREC=23,&END
&DATA MLTACC=2,PMAX=20.,BANDW=40E6,UPFREQ=8.5E9,
DNFREQ=5.5E9,&END
&RECORD RECTYP=3,OLDREC=0,NEWREC=1,&END
&DATA NANT=3,NXPON=3,SATLON=-115.,
AMOD(1)=25,AMOD(2)=25,AMOD(3)=30,
XMOD(1)=21,XMOD(2)=22,XMOD(3)=23,
UPANT(1)=1,UPANT(2)=1,UPANT(3)=1,
DNANT(1)=2,DNANT(2)=3,DNANT(3)=3,
&END
```

4. MISCELLANEOUS OPERATIONAL NOTES.

4.1 Selecting Masks for a Run.

In order to assign one or more masks to a run, a new program option has been added to the main supervisor:

(11) MASKS .

The MASKS option is the last option requested when the BEGIN command (at COMMAND READY) is used. The user may enter NONE, indicating no masking is to take place, or may enter from one to ten masks numbers,* in their order of execution. The default is NONE.

4.2 GPSCS Data Base List.

If, during a job, the GPSCS data base is accessed, a summary is provided wherein each entry is listed. The format of the summary appears in Figure 2. This feature may be overridden by proper JCL upon submitting the job.

4.3 Setting Up the Control Codes File for Batch Submission.

This section describes setting up the Control Codes File when the Interactive Program is bypassed. Each record (card) in the Control Codes File describes a particular run, in terms of input sieves, output sorts, satellite model used and masks used; the format of a Control Codes Record is contained in the Addendum to

* Mask numbers are assigned by the program upon their creation, as described in Section 2.

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| SATELLITE MODEL | | 1 | | SATLON = 0.0 | | E | |
|-----------------|---------|---------|---------|--------------|---------|---------|---------|
| XPONDER | XPONDER | XPONDER | XPONDER | XPONDER | XPONDER | XPONDER | XPONDER |
| INDEX | INDEX | INDEX | INDEX | INDEX | INDEX | INDEX | INDEX |
| 1 | 1 | 1 | 3 | 5 | * | | |
| 2 | 2 | 3 | 3 | 4 | * | | |
| 3 | 3 | 3 | 3 | 5 | * | | |
| 4 | 1 | 3 | 4 | 1 | * | | |
| 5 | 1 | 1 | 1 | 1 | * | | |
| 6 | 4 | 2 | 2 | 2 | * | | |

[illegible]

| ANTHROP METRICS | | | | | | | |
|-----------------|----------|-------|-------|--------|--------|--------|-------|
| # | MCD TYPE | GAIN | W'AMM | PLAT | PLOM | MULLAW | |
| | | CG | NEG | NEG | NEG | DR | DEG |
| 1 | FC | 20.00 | 17.30 | | | | * |
| 2 | EC | 20.00 | 17.30 | | | | * |
| 3 | FC | 20.00 | 17.30 | | | | * |
| 4 | AC | 40.00 | 16.00 | 15.00S | 30.00E | | * |
| 5 | PRFAY | 10.00 | | | | -40.00 | 10.00 |

[illegible]

Figure 2. Format of the GPSCS Data-Base Printout

4.3 -- Continued.

the Final Report [3]. When setting up a file it is necessary to provide additional information that the Interactive Setup Program would normally supply. For this reason, the following card is placed at the beginning of the file:

| <u>Columns</u> | <u>Description</u> |
|----------------|--|
| 1-3 | Number of runs this job (maximum 10). |
| 4-6 | Number of masks this job (maximum 10); leave blank if no masks are present. |
| 9 | 1=GPSCS modifications are present; leave blank if no modifications are present. |

Following the card described above, a Control Codes record is placed for each run.